Studying Classroom Interaction During a Design-Without-Make Assignment

Dr Donna Trebell, WSP Edunova

RESEARCH

Abstract
This paper explores ways in which data collected during designerly activity in a Secondary Design and Technology Classroom in the UK, can be analysed with a view to ascertaining the features of the classroom interactions which facilitate the development of designerly activity in 'fledgling designers' (Trebell, 2007). The paper builds upon earlier work (Trebell, 2007, Trebell 2008) including a pilot study (Barlex and Trebell, 2007). One research question drove this of study: *What are the features of the classroom interactions that support pupil's design activity?* This paper presents, analyses and discusses the video data collected throughout the duration of a design-without-make assignment. The data was analysed against three analytical categories drawn from the literature. These consist of: (a) *Design decisions* (Barlex, 2005), (b) *Learning conversations* (Corden 2001; Coultas, 2007; Hamilton, 2003; Kumpulainen & Wray 2002; Wegeriff and Mercer 2000) and (c) *Scaffolding and Mediation* (Schaffer, 1996; Tharp and Gallimore, 1988) supplemented by a range of *emergent categories* drawn from the data. Findings indicate that the features of the classroom interactions which support the development of designerly activity in fledgling designers are complex, multi-facetted and either enabled or disabled by the pedagogic stance adopted by the teacher.

Keywords
classroom interaction, design decisions, analysis categories

Introduction

In the view of a number of researchers (Barlex & Trebell, 2007; Hamilton, 2003; Hamilton, 2004; Hennessy & Murphy, 1999; Murphy & Hennessy, 2001; Trebell, 2007; Trebell, 2008), the nature of designing within the design and technology classroom is a social activity drawing on interaction between pupil/pupil and pupil/teacher. Previous studies, (Murphy & Hennessy, 2001) have shown that pupils seek opportunities to interact with peers even when these are not made explicit by the pedagogic stance adopted by the teacher. This view of learning as a socially mediated activity draws on the work of Vygotsky (1978: 90), who believed that:

'Learning awakens a variety of internal development processes that are able to operate only when the child is interacting with people in his environment and in cooperation with peers'.

The research central to this paper is based on the Young Foresight approach (Barlex, 1999) as it advocates the collaborative development of design ideas. This provides an excellent opportunity to research designerly activity as a socially mediated process. The site of the intervention was the Design and Technology department of a specialist Arts College in the UK with 1300 pupils aged 11–18 years. This paper builds upon earlier work (Trebell, 2007, Trebell 2008) including a pilot study (Barlex and Trebell, 2007).

The aim of this study was to research classroom interaction during designerly activity in a secondary design and technology classroom where pupils aged 14 designed but did not make products for the future, in order to ascertain the nature of the interactions which form the language of design in 'fledgling designers' (Trebell, 2007). One research question drove this study: *(a) What are the features of the classroom interactions that support pupils' design activity?*

This paper is presented in four parts. The first part consists of a literature review focussing on classroom interaction. The second part will describe the research undertaken and methodology used to capture classroom interaction. The third part of the paper will present, analyse and discuss the data using an analytical framework drawn from the literature supplemented by emergent categories from the data. The final section comprises the conclusion summarising the features of the classroom interactions which support the development of designerly activity in 'fledgling designers' (Trebell, 2007)

Classroom interaction

In recent years the role of interaction in supporting the development of learning has become very popular with a number of researchers (Edwards, 1993; Lemke, 1990; Mercer, 1995; Wells and Chang-Wells, 1992) carrying out studies in the field which have utilised video and audio recording in order to collect data and then analyse it in order to discover the nature of the interactions in different contexts. Within Design and Technology Barlex and Welch (2007); Hamilton (2003; 2004; 2007); Hennessy & Murphy (1999); Murphy & Hennessy (2001); Trebell (2008) have begun to focus on the study of a social constructivist approach to pedagogy with the quality and nature of classroom interactions assuming an important role. These studies have shown that there is a strong link between the quality of the nature of the interactions and

the overall quality of outcomes showing that classroom interaction within the subject is an important pedagogic tool.

Like all human endeavours, the process of learning and in this case learning to design can be examined from multiple perspectives. Interactions can be embedded into the process and used as a constructive tool to enable development, or they can be a by-product of a more formal classroom occurring through pupil initiation rather than premeditated pedagogical design (Hennessy & Murphy 1999; Murphy & Hennessy 2001). In the case of this study, knowledge is seen as socially constructed via means of pupil/pupil, pupil/teacher interactions. Some of these interactions involve talk functions, others are distinctly linked to designerly activity with language seen as a social mode of thinking or 'overt verbalisation' (Vygotsky, 1978; 1981; 1986). Techniques such as scaffolded sketching, where the act of sketching becomes the centrepiece of designerly conversation, with sketching used as a tool to develop a mutually appropriated concept, or as Schön (1983: 78) puts it 'a conversation with the materials of a situation' through the iterative development of the design idea represent a distinctly designerly mode of interaction.

The growing interest in classroom interactions and more generally in the processes of learning inherent in social interaction, reflect a theoretical shift in perspective from learning as instruction to learning as the co-construction of knowledge. These studies (Mercer, 2000; Resnick, Levine and Teasley, 1991; Rogoff, 1990) have begun to emphasise the social and cultural nature of human learning.

Many categories of classroom interaction have been developed which start with and build upon the work of Flanders (1970). Important for their prevalence, amongst these are the following: *speculating; explaining; elaborating; questioning; challenging; hypothesising; affirming; feedback; evaluating; reflecting*. These categories of have been drawn from the work of (Corden, 2001; Coultas, 2007; Kumpulainen & Wray, 2002; Mercer, 1995; Wegeriff & Mercer, 2000) and have been adopted as they enable the analysis of classroom interaction which is not always orchestrated by the teacher.

Methodology

This research was conducted in a design and technology department by running a design-without-make unit of work for all year 9 pupils. The unit of work being studied is based on Young Foresight (Barlex, 1999). Five teachers taught the unit of work to eleven classes but only one class was studied in detail. According to Yin (1989), small sample size (as in this study) is not a barrier to external validity provided that each study is detailed and analysis of data reveals elements of practice relevant to the study at hand.

The Educational Context and Sample

The site of the intervention was the Design and Technology department of a specialist Arts College in the UK with 1300 pupils aged 11–18 years. This school was chosen because staff at the school had experience and expertise in collaborative learning. A year 9 class (age 14 years) was chosen as Young Foresight was designed to be taught in year 9. The class of year 9 pupils chosen for this study consisted of 19 pupils, 8 girls and 11 boys.

The Teaching Sequence Studied

The unit of work took place over a sequence of 18 lessons over 8 weeks in the Spring Term of 2007. The exact nature of the content of each lesson within the teaching sequence studied is shown in table 1.

Data Gathering

In order to create a rich picture of the context, video data of classroom interaction during designerly activity was collected throughout the design-without-make assignment.

Analytical Approach and Justification

When analysing the video data the features of classroom interaction during designerly activity will be analysed from four perspectives. Three of these were derived from the literature and the fourth consists of emergent categories drawn from the data.
The analytical categories are:-

Those derived from the literature

i) Design decisions – Barlex, (2005) has suggested that in the context of school-based designing, pupils' designing could be described in terms of making five types of interrelated design decisions: (a) conceptual (b) marketing (c) technical (d) aesthetic and (e) constructional. Conceptual decisions are concerned with the overall purpose of the design. Marketing decisions are concerned with, for example, who the design is for. Technical decisions are concerned with how the design will work. Aesthetic decisions are concerned with what the design will look like. Constructional decisions are concerned with how the design will be made. This can be represented visually, as shown in Figure 1, with each type of decision at a corner of a pentagon and each corner connected to every other corner.

In trialling the use of the design decisions pentagon as an analytical tool, it became clear that inter-rater reliability

	Week 1		Week 2			Week 3	
	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5	Lesson 7	Lesson 8
Completing pre-assignment questionnaires.	Introduction to young foresight. Collaborative development of electronic products as a starter.	Toolkit activity – PIES	Reflection on PIES and how it can support the development of design ideas. Introduction to 4Rs of creativity.	Mindmap of carrying devices starting with school bags as part of 4Rs of creativity.	4Rs of creativity.	Discussion of electronic products found at home. Watching the YF films on smart and modern materials.	Watching the YF films on smart and modern materials

Week 4		Week 5		Week 6		Week 7	Week 8
Lesson 9	Lesson 10	Lesson 13	Lesson 14	Lesson 15	Lesson 16	Lesson 17	Lesson 18
Reflecting on and recapping smart and modern materials studied last lesson.	Reflecting on and recapping smart and modern materials studied last lesson. Designing for the future.	Studying designs for the future produced by previous groups. Continuing with own designs.	Designing for the future.	Designing for the future.	Completing design sheets and starting powerpoint presentations.	Completing design sheets and starting powerpoint presentations.	Completing presentations and showing these to the group.

Table 1. An overview of the lessons within the teaching sequence studied

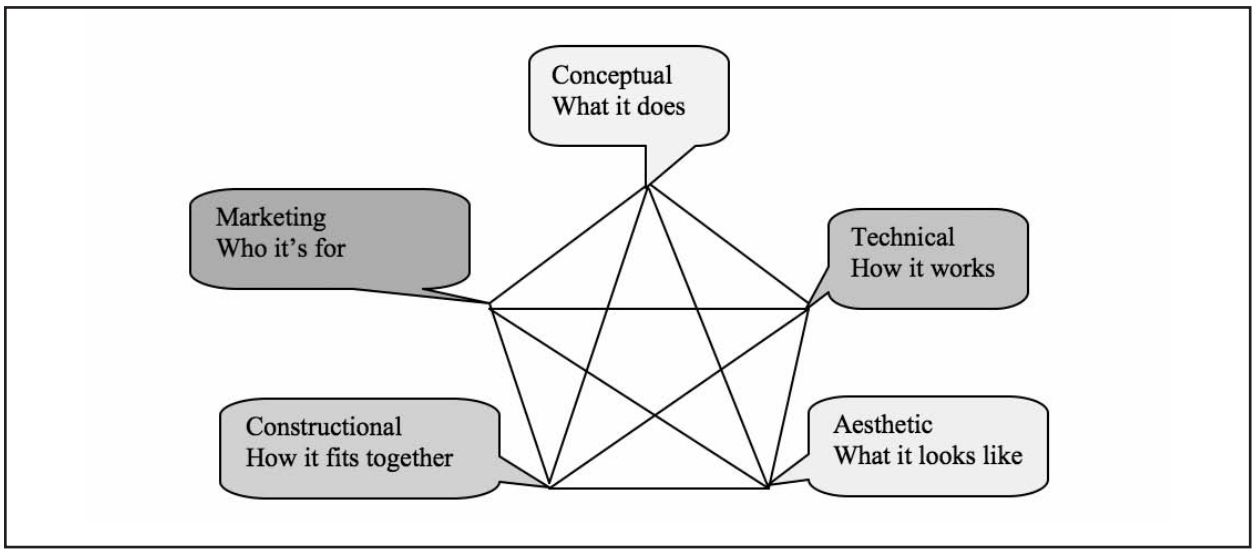


Figure 1. The design decision pentagon (Barlex, 2005)

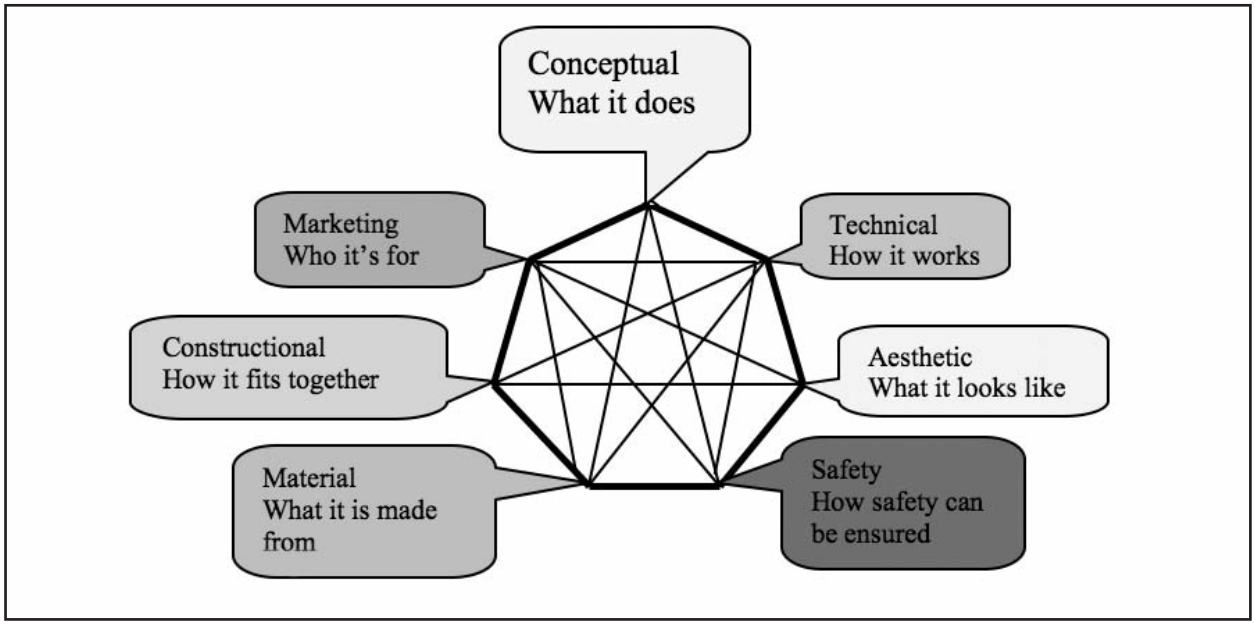


Figure 2. Design decisions heptagon

could not be ensured as the categories were open to interpretation. In order to address this issue, the original design decisions pentagon has been extended by adding two further categories. The first deals with materials, that is, what materials will be used? The second deals with safety, that is, will the product be safe to use? This can be represented visually, as shown in figure 2 with each type of decision at a corner of a heptagon and each corner connected to every other corner.

Therefore the data will be analysed in order to ascertain exactly what sort of design decisions pupils make when designing without having to make what they have designed. This has been chosen as an element of analysis due to the prevalence of interest evidenced within the literature in the field. However, it is acknowledged that the analytical categories can be further extended.

ii) Learning conversations drawn from literature on constructive dialogue - the data will be analysed with a view to ascertaining the features of the 'learning conversations' (Hamilton, 2003) which facilitate the development of designerly activity. Categories drawn from literature on constructive dialogue which illuminates a number of talk functions that empower learners in their thinking and acting: speculating, explaining, elaborating, questioning, challenging, hypothesising, affirming, feedback, evaluating and reflecting (Kumpulainen & Wray 2002; Corden 2001; Wegeriff and Mercer 2000; Coultas, 2007) will be utilised. The focus on learning conversations linked to classroom interaction is seen as vital as the quality of these conversations will either enhance or detract from the quality of the outcomes.

iii) Scaffolding and Mediation - there are a great number of different forms of adult mediation, from the adult's presence, which provides the child with a secure learning environment, to encouragement, challenge, and feedback (Schaffer, 1996). Tharp and Gallimore, (1988) have defined such forms of teacher mediation as modelling, contingency management (praise and critique, feedback), and on the other level, cognitive structuring. Scaffolding and mediation is an important focus for classroom interaction as these interactions move beyond verbal and begin to paint a rich picture of designerly interaction in this context.

Emergent Categories

It is essential that any study focussing on classroom interaction during designerly activity utilises categories drawn from the data, as well as those derived from the literature, as these will be specific to the nature of the study being undertaken. In the case of this study the following nine categories emerged: *teacher gesticulation*, the use of *visual stimulus such as laminates*, the use of *visual stimulus such as film, interactions related to pupils poor behaviour*, making *use of existing products, making graphics equipment available*, showing *examples of pupils design work, pupil gesticulation* and *the teacher exemplifying the generation and development of design ideas.*

Studying Classroom Interaction During a Design-Without-Make Assignment

Presentation, Analysis and Discussion of Data

In answering the research question: *What are the features of the classroom interactions that support pupil's design activity?* video evidence collected as pupils generated and developed their design ideas will be presented, analysed and discussed. The video evidence was collected focussing primarily on the designerly activity of four purposively sampled pupils. However, the focussed observations were supplemented by footage of teacher/whole class interaction and of the teacher moving from group to group.

Presentation of Data

In order to interrogate the data teacher/pupil, pupil/pupil interactions were presented in a grid and analysed to show the nature of the classroom interactions which took place during designerly activity. An example of the data analysis grid is shown in appendix 1.

Data Analysis and Discussion

The classroom interaction data analysis grid facilitated fine grained analysis based on three analytical categories drawn from the literature. These consist of: (a) *design decisions*, (b) *Learning conversations* and (c) *Scaffolding and Mediation*. These were supplemented by emergent categories drawn from the data.

The data has been analysed against each of the categories in turn in order to ascertain the extent to which they are an important feature of the classroom interactions which support the development of designerly activity in fledgling designers. An abstract showing the fine grained analysis grid, how it was coded for one of the categories and what the coding represents is shown in appendix 2. Tables showing the coding for the other categories are included in appendix 3.

Discussion – Design Decisions as a feature of the classroom interactions that support pupil's design activity

When interrogating the data in terms of the design decisions made, it is clear that the approach adopted by the teacher governs whether the pupils are able to make design decisions or not. This finding is in keeping with those of a number of researchers in the field (Davies, 2002; Murphy, 2003; Rutland, 2004; Hardy, 2004 and Balchin, 2005; Nicholl, 2008) all of whom found that 'the pedagogic stance adopted by the teacher either supports or restricts creative dialogue depending on its nature'. For example when the teacher was explaining or directing, the pupils were required to listen but as soon as she allowed them to generate and develop their design ideas, either collaboratively as a mindmap or on their own as a final design sheet, the design decisions began to flow. It is important to view this in light of the hegemonic approach (Lawson, 2004) often taken within Design and Technology departments where pupils are given a pre-determined design brief, an approach it could be argued that prevents the pupils from making design decisions.

Throughout the generation and development of the design ideas, the teacher modelled how to make a number of design decisions insisting that the pupils design for a market and to meet a pre-defined need. Throughout the lessons studied, the teacher showed an effective use of questioning. In one example 'think about maybe where a baby goes to sleep, there's a lot of things with cot deaths. How can maybe something with smart fabric help with cot death? What do babies have in their room when they go to sleep, so that parents can keep an eye on them?' The pupil replied that often infants have baby monitors. The teacher continued 'exactly, so they also have the little speakers, so could that be put into something else? Could it go into the bed somewhere…' This dialogue shows the teacher co-constructing conceptual, technical and safety related design decisions in a way that challenged the group to think.

When pupils began working on their design ideas it was interesting to note that they started sharing their designerly thinking with their peers. One pupil said 'I might do a TV screen which you put across there (she gesticulates across her stomach) so that you can see the baby on it. Shall I do that?' Through this comment she shares her designerly thinking but goes on to seek the approval of her peers. Hennessy and Murphy (1999) in their research into collaborative problem solving point out that 'through discourse design ideas, solutions, plans and decisions are made explicit and visible'.

One of the plenary sessions involved pupils explaining to the whole class what they were doing. One pupil said 'I am doing a coat for a horse. When it is cold it warms it up. If it is hot, it cools it down' which illustrated that the pupil had begun to make a number of design decisions. This whole class presentation of ideas is an important feature of the approach adopted by the teacher. Pupils are expected to think carefully about the design decisions they are making and be able to articulate these to the rest of the class. This ensures that the pupils pay attention and are able to present their ideas effectively. Hoyles et al, (1991) building on Vygotsky's theory propose that 'a more explicit, organised, distanced kind of understanding is developed through having to explain one's ideas to a co-learner' as is the case in this study.

When pupils were working at their tables there were a number of pupil/pupil interactions. In one example pupil A asked pupils C and D 'Are either of you two good at drawing people'. In response to this pupil C replied to Pupil A, 'I will have a go'. Pupil C sought further clarification of pupil A's requirements and then spent a little time helping her to do a drawing of a person on her sheet. In this case the pupil is adopting the role of expert and spends her time ensuring that her peer can develop the skills she needs to develop her designerly thinking. This way of working supports a social constructivist view of the co-construction of knowledge where the pupils work together to develop their skills and understanding. It also evidences what I would like to term the development of pupil A's 'zone of designerly proximal development' (Trebell, 2007) which resulted in pupil A commenting 'Oh so that is why my people never look right, because I always give them a circle head'.

Analysis and Discussion – Learning Conversations as a Feature of Classroom Interaction during Designerly Activity

The data were then analysed through a different lens with a view to ascertaining the features of the 'learning conversations' (Hamilton, 2003: 36) which facilitate the development of designerly activity in 'fledgling designers' (Trebell, 2007). The coding system used is included in appendix 3. In studying the data in order to ascertain the features of the learning conversations which take place in the designerly context being studied, it is important to note that the variety of talk functions utilised in every lesson is striking. At key points during the lesson the teacher explains what is required of the pupils. When doing so she challenges them through questioning, taking their ideas and building on them in order to scaffold their learning. In doing so, the teacher 'creates a comfortable and safe environment for thinking… where all ideas matter and where there is no right answer' (Hamilton, 2007).

Research shows that classroom activities that encourage greater independence, risk-taking and intrinsic motivation, empower pupils in their learning (Dweck, 1986; Shaughnessy, 1991; Wallace, 1996). Dialogue and conversational engagement is crucial to the creation of a participatory process, critical thinking and learner empowerment (Mercer, 2000; Shor, 1992). Throughout the study the teacher utilised a broad range of talk functions in order to facilitate the development of the pupils designerly thinking and acting. In the following extract where the teacher was collaboratively mindmapping different types of carrying devices, she utilised a number of talk functions. 'Okay, you've got your school section, because you're school pupils' she reflected and then elaborated by adding 'that's what you relate to more'. She went on to challenge them to 'think about other people's needs' and to affirm and elaborate by asking 'What kind of people need rucksacks?' This brief outline of interactions shows the complexity and variety of required to develop pupils' designerly thinking. This exemplifies a socio-cultural view of learning where 'children learn by interacting with people in their environment and in cooperation with peers' (Vygostsky, 1978: 90).

Another feature of the teacher/pupil interactions is her ability to reflect on the answers given before extending the pupils' thinking. In the view of Schön (1983) 'the effective teacher is a reflective practitioner who strives to provide a learning context that engages learners cognitively, emotionally and socially' as is the case with the design-without-make unit of work. One very important feature which I believe is the cornerstone of designerly conversations is the use of the design or sketch as the centrepiece of the conversation. This was certainly the case as the teacher modelled the production of design ideas talking through their development as she drew them on the board. It also served as a useful tool during one to one interactions where the design ideas became the centrepiece of a 'conversation with the materials of the situation' (Schön, 1983).

Another key feature of the learning conversations was the teacher's ability to relate the discussion to the real world with examples like 'Um, and this kind of device um, is similar to the ball barrow designed by James Dyson who also did the dual cyclone' and 'Any of you have a paper round? Any problems with your paper bag? Is there anything you could use to make it better? Do you walk around or bring your bag? Do you have a bag over your shoulder?'. This stream of questions served to engage the pupils.

Analysis and Discussion – Scaffolding and Mediation as features of the classroom interactions that support pupils' design activity

An example of the data analysis grid and coding are shown in appendix 2. Given the nature of the learning environment created in this study the lessons were rich in scaffolding and mediation. The following is an example of a teacher/pupil interaction where the teacher is explaining how she would develop the pupil's design further. 'I might do some detail on the side, this eventually could be string with a toggle that you could fasten something into, okay?' which evidences the use of a combination of modelling, presence, encouragement, challenge and critique to help

pupils develop their designs further. An interesting feature of this interaction is that although the teacher gives her opinion she ensures that ownership of the work remains with the pupil (Hamilton, 2007). Another example occurred when the teacher continued to circulate and interacted with the pupils critiquing their work whilst giving feedback and challenge for example 'Try and get it a lot bigger on this side.'

In order to ensure that the pupils were able to engage with the tasks, the teacher used cognitive structuring in order to break the learning sequences down into smaller elements. Throughout whole class interactions, the teacher utilised modelling extensively in order to show pupils what was expected of them. She did this when mindmapping the types of bags, taking this even further by asking them to hold their bags up and making a list of the different types available. This is similar to the ideas of a number of researchers, including that of 'the zone of proximal development' (Vygotsky, 1978), 'scaffolding' (Bruner, 1983) and 'guided participation' (Rogoff, 1990) which show that adults generally adjust their support to assist children, simplifying the task where necessary and taking over the more difficult parts. She also modelled the generation and development of design ideas for the four Rs of creativity and later when designing for the future. During this designerly modelling she made her thinking explicit by saying what she was thinking as she was drawing. This enabled the pupils to see how she was using material such as the laminates and how she was able to process this and turn it into a design idea.

Another really important part of the scaffolding and mediation that took place in these lessons was the teacher's use of questioning. Here is a sample of questions used, 'P stands for what, Georgia?' In this case the question is closed and very straightforward simply prompting recall. 'What other kinds of bags?' This question is more open and designed to make the pupils think and contribute which they did. 'When you go to the supermarket, what types of bags do you see?' This is closed prompting simple recall. 'Where's your pen?' This is directive as the teacher wants the pupil to do as he has been told. The next few questions were asked in quick succession and were designed to challenge the pupils to think about an existing product and the issues that arise from using it. 'Any problems with your paper bag?, Is there anything you could use to make it better? Do you walk around or bring your bag? Do you have a bag over your shoulder? What do you have?'

'Peers have a crucial role to play in the scaffolding of one another's learning. Group learning environments, if properly structured, (as in this case) encourage questioning, evaluating and constructive criticism, leading to a restructuring of knowledge and understanding' (Naylor & Cowie, 2000: 93). This was certainly the case in the learning environment studied where a great deal of pupil/pupil interaction took place and was noted to have a positive effect on peers. In the next example two pupils are co-constructing knowledge by considering the benefits and issues related to a particular design idea. 'You could have a T-shirt, and trousers and that yeah, and it goes like that into a big bubble when you crash' to which the other pupil replied 'if it puffs up into a bubble wouldn't it be dangerous' and the first pupil added 'no it would stop you getting hurt and it wouldn't blow up that big, just big enough to protect you' which shows that the pupils were thinking seriously about the issues inherent in their design proposal.

Analysis and Discussion – Emergent Categories as features of the classroom interactions that support pupils' design activity

There are a number of emergent categories which have been derived from the data collected. The coding for these if shown in appendix 5. Many of the emergent categories covered here resonate with key features highlighted by a number of researchers in the field (Rutland 2004; Hardy 2004 and Balchin 2005). These relate particularly to the use of stimulus material (Rutland, 2004; Balchin, 2005) in the form of laminates which were available in order to encourage the pupils to utilise 'conceptual combination', a creativity enabling technique discussed in a case study of professional designers by Nicholl et al (2008: 56) and films which were used to introduce the pupils to different forms of smart and modern materials. Both of these resources could be considered to provide the pupils with precedent (Lawson, 2004) which is a vital component of the professional designers' toolkit. The introduction of artefacts (Balchin, 2005) in the form of the pupils' school bags and designerly stories about products such as the ball barrow and De Vinci's helicopter were also key features and thus, emergent categories.

The importance of the use of gesticulation both by teachers and pupils has been a key feature highlighted in a number of studies of interaction (Mercer, 1995; Wegeriff & Mercer, 2000; Corden, 2001; Kumpulainen & Wray, 2002; and Coultas, 2007). Kimbell and Stables (2007) reflecting on prior studies noted the extent to which gesticulation was utilised in early years but declined as pupils got older. This does not appear to be the case in this study.

Conclusion

In researching the features of the classroom interactions that support pupil's design activity a number of the features have emerged as themes from the literature namely: Design decisions – Barlex, (2005); Learning conversations drawn from literature on constructive dialogue – (Kumpulainen & Wray 2002; Corden 2001; Wegeriff and Mercer 2000; Coultas, 2007) and Scaffolding and Mediation – (Schaffer, 1996; Tharp and Gallimore, 1988) but it has also been possible to identify a number of emergent categories from the data.

When considering the importance of being able to make design decisions as a feature of classroom interaction during designerly activity, this study shows that it is essential that pupils are given an opportunity to make these decisions, as in this study, where the teacher prompted the pupils to explain: Who the product was for (marketing decisions); What the product does (conceptual decisions); How it works (technical decisions); What is it made from (material decisions); What the product looks like (aesthetic decisions) and How safety can be ensured (safety decisions). It is also clear that the pedagogic stance adopted by the teacher either facilitates designerly decision making or prevents it. In conclusion enabling pupils to make a broad range of design decisions is an essential feature of the classroom interactions which support the development of designerly activity in 'fledgling designers' (Trebell, 2007) and a vital part of the development of designerly outcomes in this context.

The features of the 'learning conversations' (Hamilton, 2003) which facilitate the development of designerly activity, in 'fledgling designers' (Trebell, 2007), in this study, consist of a broad range of talk functions. This was supported by the teacher's subject knowledge and ability to draw on relevant examples of designerly activity in order to inspire design related dialogue. This is further enhanced by enabling the pupils to work within their 'zone of designerly proximal development' (Trebell, 2007) supported by more able peers and their teacher. In addition 'scaffolded sketching' (Trebell, 2007) was well used by both teacher and competent peers to support the designerly activities of others within the group. These findings can be represented diagrammatically as shown in figure 3 below.

When considering the importance of the use of different forms of scaffolding and mediation, it is interesting to note that in this study the full range of scaffolding and mediation was used. The adult's presence was highly noticeable as she supported both whole class and one to one interactions, she studied all of the pupils work and in each case praised their efforts and gave them feedback which included challenge and critique in order to enable them to improve their work further. In whole class instruction, the teacher used cognitive structuring to structure the pupils thinking through and modelling to illustrate the process. The richness of the interactions is inherent in the wide range of products being designed which necessitated the teacher interacting with pupils on a one to one basis to ensure success.

When considering the importance of a range of emergent categories as a feature of effective classroom interaction during designerly activity, it is interesting that all of those identified were well used throughout the study. Gesticulation by both teacher and pupils proved to be a

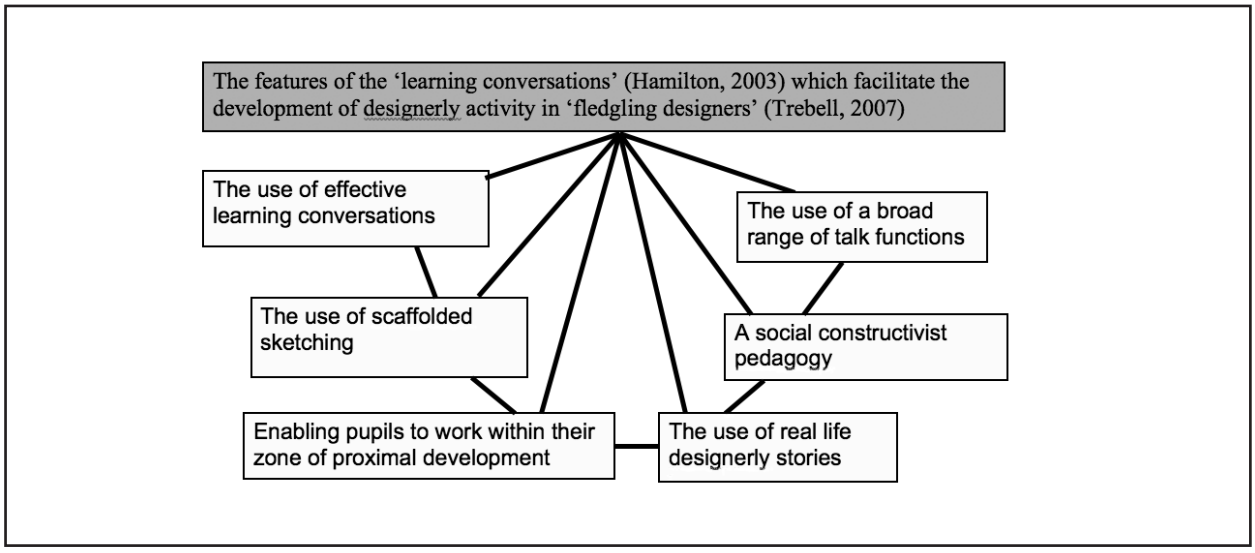


Figure 3. The features of the 'learning conversations' (Hamilton, 2003) which facilitate the development of designerly activity in 'fledgling designers' (Trebell, 2007)

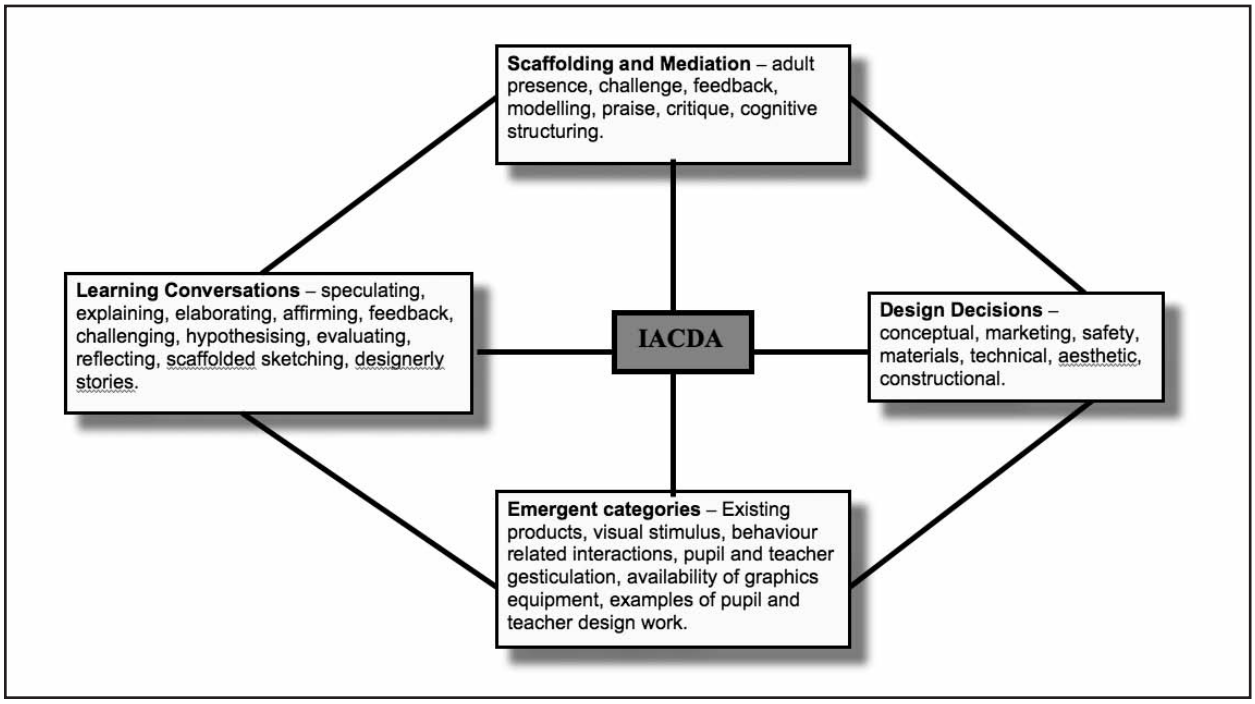


Figure 4. Interaction Analysis Categories for Designerly Activity (IACDA)

means of communication which made up for some of the lack of skill currently available in the pupils' designing repertoire. Visual stimulus in the form of both film and laminates served to inspire the pupils and to enable them to understand smart and modern materials. The use of existing products enabled the teacher to put a concrete form to some of her thinking which helped pupils to understand requirements. In the case of the graphics equipment it proved vital that the teacher understood about such equipment and was able to provide relevant items for the pupils as required. All of which helped the pupils to improve the overall quality of their design work. The last form of emergent category relates to interactions to do with managing behaviour which were well used during this study.

In summary the features of classroom interactions which support the development of designerly activity can be represented as a diamond (fig. 4) with each point of the diamond representing a set of interactions which if enabled during designerly activity, support the development of 'fledgling designers' (Trebell, 2007). It is envisaged that these categories could be utilised in future studies of designerly activity both in order to support the framing of the study and as an analytical tool. The more categories that are studied, the more detailed the analysis will be leading to a deeper understanding of the designerly context being studied.

References

Balchin, T. (2005) A Creativity Feedback Package for Teachers and Students of Design and Technology (in the UK). *Design and Technology Education: An International Journal*, 10.2, 31-43.

Barlex, D. (1999). *Young foresight*. London: Young Foresight.

Barlex, D. (2005, April). The centrality of designing: An emerging realisation from three curriculum projects. Paper presented at the PATT15 Conference – *Technology Education and Research: Twenty Years in Retrospect*, Eindhoven, The Netherlands.

Barlex, D and Trebell, D (2007). Design-Without-Make: Challenging the Conventional Approach to Teaching and Learning in a Design and Technology Classroom, *International Journal of Technology and Design Education*. Published online: 28 February 2007, http://www.springerlink.com/content/957663w4787k6123/

Barlex, D. Welch, M. & O'Donnell, E (2007) 'One Teacher's Sociocultural Constructivist Response to the Introduction of a Curriculum Unit'. In C. Benson, S. Lawson, J. Lunt & W. Till (Eds.) *Sixth International Primary Design and Technology Conference*, Birmingham, UK: University of Central England, 7-11.

Studying Classroom Interaction During a Design-Without-Make Assignment

Corden, R. (2001), Developing Exploratory Language in the Classroom: moving beyond teacher as expert, *Educational Action Research*, 9 (3), 371-393.

Coultas, V. (2007), *Constructive Talk in Challenging Classrooms*. London: Routledge

Davies, D. (2002) Paradigm? What Paradigm? *The Journal of Design and Technology Education*, 7.3, 157-164.

Dweck, C. (1986), 'Motivation practices affecting learning', American Psychologist, 41 (10): 1040-8

Edwards, D. (1993). Concepts, memory, and the organisation of pedagogic discourse: A case study. *Educational Research*, 19, 205-225

Flanders, N. (1970), *Analysing Teacher Behaviour*. New York: Addison Wesley

Hamilton, J. (2003) 'Interaction, dialogue and a creative spirit of enquiry'. In E. W. L. Norman & D. Spendlove (Eds.) *Design matters: DATA International Research Conference 2003*. Warwickshire, UK: University of Warwick, 35-44.

Hamilton, J. W. (2004) 'Enhancing learning through dialogue and reasoning within collaborative problem solving'. In E. W. L. Norman, D. Spendlove, P. Grover, & A. Mitchell (Eds.). *Creativity and Innovation: DATA International Research Conference 2004*, Sheffield, UK: Sheffield Hallam University, 89-101.

Hamilton, J. W. (2007) 'Constructing classroom learning environments that are interactive and authentic and aim for learner empowerment'. In E. W. L. Norman, D. Spendlove, (Eds.). *Linking Learning: The Design and Technology Association International Research Conference 2007,* Telford: University of Wolverhampton, 27-101.

Hardy, A. (2004), Questioning Styles: Observations of Differences in Practice in Key stage 2 and Key Stage 3, *DATA International Research Conference 2004 Creativity and Innovation*, 103-111

Hennessy, S. & Murphy, P. (1999) 'The potential for collaborative problem solving in design and technology'. *The International Journal of Technology and Design Education*, 9, 1-36.

Hoyles, C., Sutherland, R. & Healy, L.: 1991, 'Children Talking in Computer Environments: New Insights into the Role of Discussion in Mathematical Learning', in K. Durkin & B. Shire (eds.), *Language in Mathematical Education: Research in Practice*, Open University Press, Milton Keynes.

Kimbell, R & Stables, K (2007), *Researching Design Learning, Issues and Findings from Two Decades of Research and Development*, The Netherlands, Springer.

Kumpulainen, K. and Wray, D. (2002), *Classroom Interaction and Social Learning: From theory to practice*, London: Routledge

Lawson, B. (2004) *What Designers Know*, Oxford, Elsevier Ltd

Lemke, J. L. (1990). *Talking Science: Language, Learning, Learning and Values*. Norwood, NJ: Ablex Publishing Corporation.

Mercer, N. (1995), *The Guided Construction of Knowledge, Talk amongst teachers and learners*, Sydney: Multilingual Matters Ltd
Mercer, N. (2000), *Words and Minds; How we use language to think together*, London: Routledge

Murphy, P. and Hennessy,S (2001) Realising the Potential – and Lost Opportunities – for Peer Collaboration in a D and T Setting, *The International Journal of Technology and Design Education*, 11, 203-237

Murphy, P. (2003) The place of pedagogy. In D. Barlex (Ed.), *Creativity in crisis? Design & technology in KS3 and KS4* (pp. 14–17). London: Nuffield Foundation.

Nicholl, B; McLellan, R & Thomas, M. (2008), A case study illustrating a designer's use of two creative processes: conceptual combination and analogical thinking, and the implications for teaching and learning in design and technology. In E. W. L. Norman, D. Spendlove, (Eds.). Designing the curriculum – making it work: *The Design and Technology Association International Research Conference 2007*, Telford: Loughborough University, 55-61.

Resnick, L. B., Levine, J.M. and Teasley, S.D. (Eds.). (1991). *Perspectives on Socially Shared Cognition*. Washington, DC: American Psychological Association.

Rogoff, B. (1990). *Apprenticeship in Thinking: Cognitive Development in Social Context*. New York: Oxford University Press.

Rutland, M. (2004), Creativity: is it on the Key Stage 3 (11-14 years) Design and Technology (D and T) Agenda. *DATA International Research Conference 2004* Creativity and Innovation, 167-171.

Schaffer, R. (1996) Joint involvement episodes as context for development. In H. Daniels (Ed.), *An Introduction to Vygosky* (pp. 251-280). London: Routledge.

Schön, D. A. (1983) *The Reflective Practitioner: How Professionals Think in Action*. London, Temple Smith

Shor, I. (1992). *Empowering education: Critical teaching for social change.* Chigago: The University of Chicago Press.

Shaughnessy, M. (1991). *The supportive educational environment for creativity.* (ERIC Document Reproduction Service NO. ED 360 080)

Tharp, R., & Gallimore, R. (1988) *Rising minds to life: Teaching, learning and schooling in social context.* Cambridge: Cambridge University Press
Trebell, D. (2007). A Literature Review in Search of an Appropriate Theoretical Perspective to Frame a Study of Designerly Activity in Secondary Design and Technology, In E. W. L. Norman, D. Spendlove, (Eds.). *Linking Learning: The Design and Technology Association International Research Conference 2007*, Telford: University of Wolverhampton, 91-94.

Trebell, D. (2008). 'Focussing on Classroom Interaction During Designerly Activity in a Secondary Design and Technology Classroom'. In E. W. L. Norman, D. Spendlove, (Eds.). *Designing the Curriculum – Making it work: The Design and Technology Association International Research Conference 2008*, Telford: University of Wolverhampton, 75-81.

Vygotsky, L.S. (1978) *Mind in Society: The Development of Higher Psychological Processes.* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Trans.) Cambridge, MA, Harvard University Press.

Vygotsky, L.S. (1981) The genesis of higher mental functions. In J.V. Wertsch (Ed.), *The concept of activity in Soviet psychology* (pp. 144-188). Armonk, NY: Sharpe

Vygotsky, L. S. (1987). *The collected works of L. S. Vygotsky: Vol. 1, Problems of general psychology. Including the volume Thinking and speech* (N. Minick, Trans.). New York: Plenum

Wallace, G. (1996). 'Engaging with Learning'. In J. Ruddock, R. Chaplain and G. Wallace (eds), *School Improvement: What can pupils tell us?* London: David Fulton.

Wells, G. and Chang-Wells, G.L. (1992). *Constructing Knowledge Together: Classrooms as Centres of Inquiry and Literacy*. Portsmouth, NH: Heinemann.

Wegerif, R. & Mercer, N. (2000). Language for thinking: In H. Cowie & G.van der Aalsvort (Eds), *Social Interaction in Learning and Instruction*. Oxford: Pergamon Press

Yin, R. K. (1989). *Case Study Research Design and Methods*, Newberry Park, Sage.

donna.trebell@edunova.co.uk

Disc	Lesson 15 and 16	What teacher says to the whole class	What pupils say	What teacher says to individuals	What pupils say in response to the teacher	What pupils say to each other	Non verbal communication
	Main – 70 mins Image 42: 5 minutes  into the lesson Image 43: 10 minutes  into the lesson	Now, this is an example of how you could do it. This is all in felt tip pen because it is bright, so you can see it. Keep thinking about the layout. The picture in the middle… The picture in the middle is a bit too small, I think, yeah? How do you think that works. This is not finished obviously, this is taking what we started last week from Martin, so it is my t-shirt at the side, and then I'm putting in boxes all the different areas that I need to look at. So, what is it? How does it work? Who is it aimed at? Why do this T-shirt? Okay? So, you're looking at all these different things. Everything that you've mentioned are the things that I thought you should put on there as well. So, something nice, bright and catchy but something that's well presented. I do have felt pens for you to use, but they're better off used as a highlighter, rather than blocking in whole areas of colour, because they can bleed and it can not look very nice, okay? Okay, you are still producing excellent work. You have come up with some fantastic ideas, and you are going to carry on now with where you left off last lesson. So, Danielle, here's yours. Can you get yourself a drawing board as well people. Claire, Lewis, Ruby, John, Tom, Henry, Natalie, Josh, Tracey These are the only pencils that I have ….two, three, four, five, six, seven And stop it with the rulers. Otherwise I will have to take them off you.			Can I use that one	Pupil A to pupil C – mine doesn't look good. I am not sure what I am doing. I have got to change this. Pupil C – It is fine. Pupil A to pupil C – I want to do a big title like you. Pupil C – Go on then. Pupil A – I am going to start again.	There is a great deal of movement as pupils collect drawing boards and other equipment.

Appendix 1. Presentation of fine grained analysis grid

Studying Classroom Interaction During a Design-Without-Make Assignment

Disc	Lesson 10	What teacher says to the whole class	What pupils say	What teacher says to individuals	What pupils say in response to the teacher	What pupils say to each other	Non verbal communication
10	Continuing to generate design ideas  Image 21: 61 minutes into the lesson  Image 22: 62 minutes into the lesson  Image 23: 63 minutes into the lesson			Right what are you doing then? Okay. Okay, good. So, it is going to be flexible is it, good. Okay, so you need to explain to me why, why you've got a voice box in here a box in here Instead of having the little speaker things at the side of the bed …the little green things to tie them up. So, you need to explain the columns here. It is in your head but you need to get that on paper as well. Okay, good, um what else…[unclear] you know, we're not [unclear, over spoken] can't you	So that the mum can hear the baby. Yes it is just the same but it is in here. You're doing it as it comes [?]. No, I'll do that this evening [?]. Okay, look…	Pupil A to pupil E – I am doing a scanner so that you can see your baby. Good isn't it.	During this lesson pupils either have their head down getting on with their work or else the seek advice from the teacher or from their peers. There is quite a lot of movement around the classroom in order to facilitate the discussions but this supports some very rich interactions.

Adult's presence	Encouragement	Challenge	Feedback	Modelling	Praise	Critique	Cognitive structuring

Appendix 2. An abstract showing fine grained analysis of scaffolding and mediation, how it was coded and what the coding represents.

Appendix 3. Tables showing the coding systems used when analysing design decisions, learning conversations and emergent

Design Decisions Key						
Materials	Safety	Aesthetic	Technical	Conceptual	Marketing	Constructional

Table 1. Coding system used when analysing design decisions

Learning conversations – Key				
Speculating	Explaining	Elaborating	Questioning	Affirming
Feedback	Challenging	Hypothesising	Evaluating	Reflecting

Table 2. Coding system used when analysing learning conversations

Emergent categories - Key				
Teacher Gesticulation	Use of visual stimulus material – laminates	Use of visual stimulus – films	Interactions to modify pupils' poor behaviour	Making use of existing products
Use of graphics kit	Exemplar material – pupils' work	Exemplar material – teachers' own work	Pupil Gesticulation	

Table 3. Coding system used when analysing emerging categories